MIT LIBRARIES
3 9080 02762 8723

MASS. INST. TECH.
DEC 1920
LIBRARY

DIFCO

ENDOCRINES ENZYMES AND PROTEIN COMPOUNDS

615.3
D57

DIGESTIVE FERMENTS CO.
DETROIT, MICHIGAN, U. S. A.

MASS. INST. TECH.
28 DEC 1929
LIBRARY

DIFCO

ENDOCRINES ENZYMES AND PROTEIN COMPOUNDS

DIGESTIVE FERMENTS CO.
DETROIT, MICHIGAN, U. S. A.

615.3
D57

Foreword

As a result of research extending over a period of years, and a study of the medical and scientific literature available, we have prepared from time to time bulletins giving chemical and therapeutic information in connection with the manufacture and use of "Difco" Digestive Enzymes and Animal Derivatives.

This material has been compiled and amplified. It is now presented to you in the form of a booklet which we believe will prove a convenient reference manual for the manufacturing pharmacist and chemist. The booklet comprises a summary of the available authoritative information on the subject of Endocrines, Digestive Enzymes and Protein Compounds.

◆

DIGESTIVE FERMENTS CO.
Detroit, Michigan U. S. A.

August, 1923

THE
ENDOCRINES

THE ENDOCRINES

Viewed in a broad sense, some authors claim that every organ and tissue in the body possesses an internal secretory function. They claim that each one gives off to the blood stream one or more substances capable of maintaining the physiological well-being of the individual, and the failure of any one of them to supply their important substances upsets the so-called "Endocrine Balance."

Physiologists have divided the Glandular organs of the body into two well defined groups:

(1) The Duct Glands which manufacture or secrete a definite substance which is supplied to the organism through a special duct or tube, and

(2) The Ductless Glands which have no such duct, and whose secretions are passed directly into the blood.

The study of the external secretions of the duct glands is relatively simple. From them are prepared the important therapeutic agents Pepsin and Rennin from the stomach; Amylopsin, Trypsin and Steapsin from the pancreas; Ptyalin from the salivary gland; Bile from the liver, etc.

The study of the second group or ductless glands is much more difficult. Here we have no external secretion and the whole activity is intimately bound up in an internal secretion which passes directly from the gland to the blood stream. The designation of "endocrine organ" or "endocrines" to these ductless glands seems preferable and the active principles present in these internal secretions are termed "hormones."

Although this classification into duct and ductless glands is very convenient, it is now recognized that it is not strictly scientific from the standpoint of organo-therapy. It has been found that even in those glands which are provided with ducts the functions are not limited to the production of their external secretions, but they produce internal secretions as well. The best example of this type of gland, and the one which today is attracting wide-spread attention, is the pancreas or sweetbread. This gland, in addition to its external secretion of the pancreatic juice through the external duct, also has an internal secretion which goes direct into the blood and keeps in check or balances the amount of sugar present in the blood, and other body fluids.

The discussion of this internal secretion will be found in detail in the treatise on Pancreas Islets, or I'lang-hans. It is there shown that in cases of diabetes mellitus, the internal secretion of the pancreas has ceased to function properly, and the administration either orally or subcutaneously of preparations containing this active hormone or internal secretion obtained from healthy pancreas, to patients whose pancreas is deficient in it, so assists the injured or torpid pancreas that it is able to hold in check or consume the sugar of the diet.

The theory in the administration of these endocrines in the treatment of disease is based upon the assumption that the hormones contained in the internal secretions of the living animal glands are preserved intact during the manufacturing processes to which they are subjected. This has been found true in the liquid extractions made from them as well as in the desiccated powders. Some of these products, such as desiccated Thyroid and Suprarenal glands, also Liquid Pituitary, (Liquor Hypophysis) and Epinephrin Chloride Solution 1:1000 have been placed upon an officially standardized and therapeutic basis.

The big problem confronting us today is to isolate the active hormones of the glands not so well known and place them on a scientifically standardized and therapeutic basis.

In combining the various glandular preparations it is important to remember the relations which have been shown to exist between these various endocrines. Some glands act in harmony with one another, others are antagonistic as for instance; the Thymus is reinforced by the Thyroid, Pituitary, Cortex of the Adrenals and the Parathyroid glands. On the other hand the Thymus is antagonistic to the medulla of the Adrenals (or suprarenal gland), and chromaffin system, and the gonads, or sex glands. The Parathyroid, Pineal and Suprarenals co-operate with one another.

The Gonads, so called, are the endocrine elements in the sex glands, the testes (Orchic Substance) in the male, and the ovaries in the female.

It is generally accepted that in addition to their normal functions and external secretions, they secrete internally substances which, absorbed by the blood stream, influence the characteristics of the body and particularly the so-called secondary sex traits.

They are regarded as stimulators or activators of the general cell chemistry. The lack, in either gland, of internal secretion leads to sluggishness of the ultimate body cells with consequent incomplete oxidation and elimination of waste products.

The obesity of the eunuch is a good example of the results of the removal of the testicles in the male, with the consequent loss of internal secretion; likewise the clinician is familiar with the sudden increase in weight which women so often experience at the menopause.

Another interesting relationship has been said to exist between three of the ductless glands and that is their influence over the growth of the individual.

(a) The Thymus gland, located in the neck, is said to control the physical growth,

(b) The Pineal gland, located in the brain, the mental growth, and

(c) The Thyroid gland, located in the neck, the development of the functions that mark mature life.

In administering these endocrines prepared from healthy tissue, there are three objects in view:

The replacement of lost or deficient secretions of like character,

The awakening or renewing of dormant or impaired glandular function, and moreover,

In certain cases, the physiologic antagonism that exists between the two glands is taken advantage of in prescribing the extracts.

In the subject matter to follow we offer these words of explanation. We feel that we as manufacturers have performed our duty when we study:—

1st. The methods of collecting and preserving the fresh glands after removal from the animal.

2nd. Their subsequent treatment in extracting and protecting intact their active principles, and

3rd. Finally, their standardization and manufacturing control so as to place them in the hands of the medical man with their potency unimpaired.

We prefer to leave their therapeutic indications to the medical fraternity. However, at the suggestion of many of our friends we attempt, here briefly, to name the most important functions of each endocrine and then to suggest the recognized application of the extract or active principal of it as recorded in the medical literature.

APPENDIX

Source and Parts Used:

The mucous membrane of the appendix of hogs and sheep is used.

Anatomy and Physiology:

The appendix, varying in length according to the animal from which it is taken, is the blind sac projecting from the cecum. It is rudimentary in human beings. It is claimed that the appendix produces an internal secretion which excites peristalsis.

Therapeutic Indications:

Desiccated appendix has been used in disorders of the digestive tract, intestinal stasis and constipation.

Adjuvants:

Digestive enzymes and salines.

Preparations Available:

Both calves and hogs appendices are purchasable on the market in the form of desiccated powder. One part of the desiccated powder is equivalent to twelve parts of fresh appendix.

Dose:

It is not possible at present to suggest a dose.

BRAIN

(Cerebral Substance)

Source and Parts Used:

The Brain of calves and sheep is used.

Anatomy and Physiology:

The Brain is that part of the central nervous system contained in the cranial cavity and consisting of the cerebrum, the cerebellum, the pons, and the medulla oblongata. There is no direct evidence that the brain secretes an internal secretion, but in common with the other glands and organs of the body, it will undoubtedly be shown to possess one.

Therapeutic Indications:

Brain and nerve substance contain two very important elements, lecithin and cholesterin. Lecithin, an organic phosphorous compound of very assimilable form, is recommended in nervous disorders where phosphorous is indicated.

Desiccated Brain is recommended as a general nerve sedative, and its use has been favorably mentioned in various mental conditions, including dementia, dementia praecox and melancholia. It has been used as a sedative in place of the usual synthetic hypnotics. In many cases of epilepsy it has shown some improvement.

An emulsion made from the white substance of the brain of cattle called thromboplastin, is used locally as a hemostatic in hemorrhage of the nose and throat. Brain substance has proven very useful after the removal of the tonsils and adenoids.

Counter Indications:

Arterial hemorrhage.

Adjuvants:

Hemoglobin, desiccated orchic and suprarenal substance and nuclein.

Preparations Available:

Desiccated whole brain. desiccated cerebrum and desiccated cerebellum, in the form of capsules and tablets. One part of desiccated whole brain is equivalent to about ten parts of fresh substance.

Lecithin and Cholesterin from brain tissue.

Dose:

Five to ten grains of the desiccated whole brain, gradually increased if necessary, three or four times daily after meals.
One-half to three grains lecithin, three times per day.

For a discussion on Lecithin see Page 82.

CARDIAC (HEART) SUBSTANCE

Source and Parts Used:

The whole organ from healthy calves is the part used.

Anatomy and Physiology:

The heart is a hollow muscular organ, the function of which is to pump the blood through the vessels. Structurally, the heart is divided into two symmetric halves, a right auricle and ventricle and a left auricle and ventricle.

Therapeutic Indications:

The function of the internal secretion of the heart is not known, nor are we positive that it has one. The assumption is, however, that in keeping with the other glands and organs of the body, it also develops an internal secretion which enters the blood stream and assists in maintaining endocrine balance.

Preparations Available:

Desiccated cardiac substance; one part of which is equivalent to about six parts of fresh tissue.

Dose:

It is not possible to suggest a proper dosage.

DUODENAL SUBSTANCE

Source and Parts Used:

About eight to twelve inches of the upper portion of the mucous membrane of the small intestine of pigs is the part used. Due to the method of obtaining, namely, the scraping of the mucous coating with a sharp knife, this material is, strictly speaking, duodenal scrapings.

Anatomy and Physiology:

The Duodenum is the first part of the small intestine beginning at the pylorus. It is the most fixed part of the small intestine, consists of an ascending, descending and transverse portion, and contains the opening of the pancreatic duct and the common bile ducts.

In 1902 Doctors Starling and Bayliss demonstrated that the digestive secretions, especially that of the Pancreas, are called forth by an activator or "chemical messenger" which they called "Secretin," formed in the mucous membrane of the duodenum and reaching the digestive glands through the blood stream. To prove their theory they rubbed up some duodenal mucosa with hydrochloric acid and sand, filtered, neutralized the filtrate and injected it in small doses into the blood stream. To their great surprise a copious secretion of Pancreatic juice was produced in a few minutes. Later other investigators showed that this same filtrate exerted a similar effect, but in a lesser degree, upon the flow of the secretions of the liver and duodenum. Starling's results were obtained by intravenous injections of the active "hormone," a procedure which today is being supplanted by the oral administration of the desiccated duodenal substance.

Some investigators claim that the Secretin of the mucous membrane not only activates and augments the flow of the Pancreatic juice proper, but also activates and augments the secretion of the internal hormone of the splenic or small end (Islands of Langerhans) of the pancreas, so popular now in treatment of diabetes of pancreatic origin.

Therapeutic Indications:

Duodenal substance is indicated in diseases due to disordered digestive functions and faulty digestion, constipation and hepatic torpor.

Counter Indications:

Duodenal scrapings are counter-indicated in ulcer of the small intestine and inflamation of the pancreas and liver.

Adjuvants:

As intestinal digestive aids, Pancreatin and Papain; as an aid in diabetes of pancreatic origin, I'lang-hans or the desiccated active Islands of Langerhans.

Preparations Available:

Desiccated duodenal scrapings in the form of capsules and tablets. One part of the desiccated powder is equivalent to about eight parts of fresh substance.

Dose:

Infants: one-quarter to one-half grain at each feeding.

Adults: two to five grains immediately before meals.

KIDNEY SUBSTANCE

(Renal Glomerular)

Source and Parts Used:

The Glomerular substance of the kidneys of hogs, sheep and cattle is used.

Anatomy and Physiology:

The kidneys are two in number. They are large glandular organs situated in the upper and posterior portion of the abdominal cavity, and are concerned in the excretion of the urine. Structurally they are divided into two parts, the outer or cortical layer, and the inner or medullary portion. The medulla consists of from eight to eighteen pyramids. The blood vessels of the kidney divide into two sets of branches, one supplying the cortex, the other the medulla.

Experiments are now in progress to determine the therapeutic indications of each substance.

Therapeutic Indications:

The desiccated whole organ is indicated in various forms of renal inefficiency, including ischuria, anuria, albuminuria and some forms of Bright's disease. Some authors also claim that the kidney substance reduces albumin and increases urea.

Adjuvants:

Desiccated liver and pancreas substance.

Preparations Available:

Desiccated kidney substance, in the form of capsules and tablets. One part of the desiccated powder is equal to about six parts of the fresh substance.

Dose:

Five to ten grains, three times a day, between meals.

LEYDIG CELLS

Source and Parts Used:

The large cells in the seminiferous tubules of bulls are the parts used.

Anatomy and Physiology:

The Leydig cells, or interstitial cells of Leydig (otherwise known as Henle's cells) are large cells interspersed throughout the sex glands, and especially the testicles. They are composed of granular protoplasm and one or more relatively small nuclei. It has been suggested that these cells properly might belong to a "Male Corpus Luteum." By these cells Spermin is secreted. Desiccated Leydig cells are said to stimulate the endocrine function of the sex glands.

Therapeutic Indications:

Leydig cells are indicated in impotence and deficient gonad function, senility, etc.

Adjuvants:

Thyroid U. S. P.

Preparations Available:

Due to the care necessary to dissect this material the cost of the isolated cells makes their marketing in pure form prohibitive; however, their therapeutic action is obtained by the oral administration of desiccated Orchic substance.

LIVER SUBSTANCE

Source and Parts Used:

The parenchymatous tissue of the liver of cattle and hogs is used.

Anatomy and Physiology:

The liver is the largest gland in the body. It is situated on the right side of the abdominal cavity, just below the diaphragm and forms an appendage of the digestive tract. Anatomically it consists of five lobes which in turn are made up of lobuli and these in turn of hepatic cells, capillaries, arteries, veins, lymphatics and biliary channels.

The best known functions of the liver are:

(a) The secretion of bile.
(b) The formation and storage of glycogen.
(c) The production, at least at a certain period of development, of blood corpuscles.
(d) The formation of a large quantity of urea.
(e) The retention and destruction of certain poisonous substances absorbed from the intestinal tract.
(f) The assistance, by the secretion of bile, in the transition from stomachic to pancreatic digestion, to render the pepsin of the gastric juice inert and protect the trypsin of the pancreatic secretion until the conditions are correct for tryptic digestion to begin.

Therapeutic Indications:

Desiccated liver substance is indicated in functional hepatic insufficiencies as well as such organic manifestations as alcoholic liver, etc. It is also used as an adjuvant in cholelithiasis. On account of its so-called detoxicating powers it is used with success in such diseases as rheumatism, gout, etc.
Desiccated liver substance has also been recommended for a form of diabetes due to a disturbance of the liver function, but this form of diabetes is not nearly so common as diabetes of pancreatic origin.

Counter Indications:

In diabetes of pancreatic origin.

Adjuvants:

Spleen substance, bile salts, and small doses of thyroid extract.

Preparations Available:

Desiccated Liver substance, one part of which is equivalent to about five parts of the fresh substance.

Dose:

In well defined hepatic disorder the dose recommended is fifteen to sixty grains of desiccated powder just before meals three or four times a day. In less severe conditions a fraction of this amount is effective.

LUNG SUBSTANCE

Source and Parts Used:

The lung tissue from very young and healthy animals, preferably lambs, is used.

Anatomy and Physiology:

The lungs are the two organs of respiration in which the impure venous blood is oxidized by the air drawn through the trachea and bronchi into the air-vesicles. The lungs are situated in the thoracic cavity and are enveloped by the pleura. They properly consist of minute air-vesicles held in place by connective tissue. Capillaries traverse the walls of these air-vesicles and bring the circulating blood in close proximity to the air.

Therapeutic Indications:

French investigators have recommended lung extract in all chronic diseases of the lungs and pleura, especially those of purulent character.

Preparations Available:

Desiccated lung tissue, one grain of which is equivalent to about six grains of the fresh tissue.

Dose:

Ten to twenty grains orally four to six times a day. The administration must be given over a long period.

NOTE: Fresh lung tissue also contains an anti-hemorrhagic enzyme which exerts quite an appreciable effect upon the control of hemorrhage.

LYMPHATIC GLANDS

Source and Parts Used:

The lymphatic glands of cattle.

Anatomy and Physiology:

The lymphatics are a system of vessels and glands accessory to the blood vascular system, conveying the lymph. They begin as innumerable capillaries in interspaces of tissues. These form a net work studded with lymph-glands that act as filters and finally all those below the diaphragm unite in the receptaculum chyli on the second lumbar vertebrae.

It is quite generally recognized that the function of the lymphatic glands is to produce an internal secretion which protects the body against bacterial invasion. The administration of lymphatic gland substance is said to cause a favorable leucocytosis. Lymphatic enlargements, especially adenoids and hypertrophied tonsils, are appreciably modified by the use of this substance.

Therapeutic Indications:

Lymphatic gland substance is indicated in children from five to ten years of age with enlarged tonsils and adenoids; also as a reconstructive measure compounded with other substances.

Adjuvants:

Thyroid, spleen and orchic substance.

Preparations Available:

Desiccated lymphatic substance in the form of tablets and capsules. One part of the desiccated lymphatic substance is equivalent to about eight parts of the fresh tissue.

Dose:

One-half to one grain, gradually increased to five grains, three times a day.

MAMMARY GLANDS

Source and Parts Used:

The lactating glands of goats, ewes and cows. Only the parenchymatous portion of the gland is used. They are considered accessory glands of the generative system.

Anatomy and Physiology:

There are two mammary or milk secreting glands, which vary in size and weight, depending upon the animal. They are composed of lobes, subdivided into lobules and bound together with connective tissue. The smallest lobules consist of a cluster of rounded alveoli, which open into the smallest branches of the excretory ducts; these ducts, uniting, form larger ducts which terminate in single canals, called lactiferous ducts. The number of lactiferous ducts vary. The function of the internal secretion of the mammary is to antagonize the ovary in both its ovulating and menstruating activities.

Therapeutic Indications:

Mammary gland preparations are believed to induce contraction of the uterus and are employed in cases of uterine hemorrhage and discharge. It has also been suggested in deficient lactation, in atrophy of the breasts, and in ovarian and tubal diseases. It is claimed that in cases where the menstruation is unduly prolonged the flow can be immediately corrected by beginning the administration of Mammary substance on the third day of menstruation, also that premature menstruation can be deferred and made normal by administering mammary substance for a week before the expected period.

Counter Indications:

Where there is deficient ovarian activity and amenorrhea.

Adjuvants:

Pituitary, placenta and similar galactagogues.

Preparations Available:

The desiccated powder, one part of which is equivalent to about eight parts of the fresh substance. The powder is compressed into tablets or placed in capsules.

Dose:

Two to ten grains orally three times a day with meals. It is recommended to periodically increase and decrease the dosage.

ORCHIC SUBSTANCE

Source and Parts Used:

The testicles of bulls is the usual source of supply.

Anatomy and Physiology:

The testicles are two in number suspended in the scrotum from their posterior edge by means of the spermatic cord.

In considering the internal secretion of the testicles it should not be confused with the external secretion, the seminal fluid. The function of the internal secretion is to control the development of the masculine sex characteristics, and to promote sexual desire and sexual activity. The removal of the testicles results in profound changes such as the development of feminine characteristics, enlargement of the breasts, a high pitched voice, etc.

Therapeutic Indications:

Testicular extract or orchic substance is indicated in sterility, premature senility and arrested growth.

Adjuvants:

Prostate and thyroid glands.

Preparations Available:

The desiccated parenchymatous tissue, one part of which is equivalent to about nine parts of fresh orchic substance, also a sterile solution for hypodermic use.

Dose:

One to five grains or more of the powder. One cubic centimeter of the sterile solution for hypodermic injection.

OVARIES

Of all the glandular extracts at present in use none are more valuable or wider in their application than the various preparations of the ovary.

Three separate preparations of the ovaries are available.

(a) The whole ovary.
(b) The corpus luteum.
(c) The ovarian residue (ovary minus corpus luteum).

These preparations differ widely in their indications, administration, therapeutic value and action.

Source and Parts Used:

In the administering of these various substances the ovaries from cows, pigs and sheep, are usually used.

Anatomy and Physiology:

The Ovaries are glandular organs giving rise to ova. There are two of them, one on each side of the uterus in the pelvic cavity They consist of a fibrous framework in which are embedded the Graafian follicles. It is a well recognized fact that the ovaries secrete an internal secretion which exerts a very profound influence upon the general metabolism of the female, since extirpation of both ovaries results in a loss of the power of reproduction and usually also in atrophy of the breasts, uterus, vagina, and external genitals. There seems to be sufficient proof to support the claim that the ovaries control ovulation, and stimulate menstruation. They also have a direct influence upon the sex characteristics, for following the removal of the ovaries the female loses the feminine voice, hair grows on the upper lip and chin and she acquires more masculine outline.

Therapeutic Indications:

Whole ovarian substance is indicated in those cases where there is a deficiency or irregularity of ovarian action, especially at puberty and the menopause, both natural and surgical.

Preparations Available:

Whole ovary is supplied in the form of the desiccated powder, compressed tablets, gelatin capsules and in sterile solution for hypodermic use. One part of the desiccated substance is equivalent to about seven and one-half parts of fresh ovary. One cubic centimeter of ovarian solution contains one-third grain (0.02 gram) of soluble extract derived from the ovary which is equal to the soluble ingredients from about twenty-two and one-half grains of fresh substance.

Counter Indications:

In pregnancy, cases of hypersecretion of the ovary, extreme pelvic congestion.

Adjuvants:

Thyroid extract, pituitary and suprarenal glands.

Dose:

Fifteen grains of desiccated whole ovary during twenty-four hours is a safe dose; taken usually in two to five grain doses three or more times a day after meals. In chronic cases administration should be begun immediately after menstruation ceases, but it is discontinued during flow. One cubic centimeter of the solution for hypodermic injection, in cases of delayed and imperfect development of the reproductive system, and in disorders of the menopause.

CORPUS LUTEUM

Source and Parts Used:

The Corpus Luteum is a yellow mass in the ovary in the place of an ovisac which has discharged its ovum.

Anatomy and Physiology:

The Corpus Luteum is that part of the ovary which bears a definite relation to menstruation and pregnancy. Its function is primarily in preparing the uterus for pregnancy, and it may also stimulate menstruation. Two types are recognized, the corpus luteum of menstruation, which lasts about two weeks after ovulation and finally disappears; if, however, conception has taken place the corpus luteum remains and becomes the true corpus luteum of pregnancy. It continues to increase in size until about the third month, when it also gradually shrinks and finally disappears.

Many authors claim that the lack of the activities expected from the corpus luteum in early pregnancy is unquestionably one of the chief factors in the nausea of pregnancy.

Therapeutic Indications:

Corpus Luteum is indicated in delayed or scanty menstruation, in sthenic cases, in dysmenorrhea with a tendency to clotting of the blood, to control the nausea of pregnancy, habitual abortion without demonstrable cause and sterility.

Counter Indications:

In pregnancy, cases of hypersecretion of the ovary, extreme pelvic congestion, goiter.

Adjuvants:

Same as for whole ovary.

Preparations Available:

Desiccated powder, tablets, capsules, and solution for hypodermic use. One part of the desiccated powder represents about six and one-half parts of the fresh corpus luteum.

One cubic centimeter of the sterile solution contains one-third of a grain of soluble corpus luteum powder equal to about twenty grains of fresh substance.

Dose:

The method of administration is similar to that described under the whole ovary. The sterile solution is injected in doses of one cubic centimeter either intravenously in severe cases, or intramuscularly in mild cases of nausea.

The dose of the desiccated powder is three or four grains orally per day.

Caution:

A word of caution is needed. The presence of goiter in early pregnancy is believed to contraindicate the administration of corpus luteum.

OVARIAN RESIDUE

Source and Parts Used:

Ovarian residue, i. e., ovarian substance without corpora lutea is, as the name indicates, the tissue remaining after the removal of the corpora lutea.

Therapeutic Indications:

Ovarian residue is indicated, in general, in those cases in which it is desired to stimulate the ovary without increasing the activity of the corpus luteum; late development of puberty, infantilism, irregular menstruation at puberty, etc.

Preparations Available:

Desiccated powder, one grain of which represents about eight and one-half grains of the fresh substance in capsules and tablets; also a sterile solution for hypodermic use.

Dose:

Five grains of the desiccated powder orally three times a day for two weeks before the expected menstruation.

One cubic centimeter of the sterile solution for injection.

PANCREAS ISLETS

(Islets of Langerhans)

Source and Parts Used:

The Splenic or small end of the Pancreas of hogs and calves is used.

Anatomy and Physiology:

The Pancreas is a racemose gland, lying transversely across the posterior wall of the abdomen. Its right extremity, the head, lies in contact with the duodenum; its left extremity, the tail, is in close proximity to the spleen.

The Pancreas has come to be considered as an organ with a double secretion, an internal as well as an external one. For many years the external secretion, containing the digestive enzymes, has been known and studied. Probably its best known uses are in the peptonization of milk for infant feeding and its administration for digestive disorders of tryptic and amylolytic origin due to a faulty pancreas.

About thirty years ago it was shown that the removal of the splenic end or tail of the Pancreas produced severe fatal diabetes. It was natural to assume that the cause of this reaction was the removal of some active "hormone" or internal secretion which this portion of the gland supplied. Experimentation has proven the soundness of this theory, and it has been demonstrated that the pancreas secretes an internal secretion which oxidizes the carbohydrates of the diet, acts as a check on the liver, and controls the normal sugar balance of the blood.

It is worthy to note that Stedman, in the 1916 edition of his Medical Dictionary, records as follows:

> "INSULINE (insulen) L. *insula*, island (referring to Langerhans' islands in the pancreas). A hypothetical hormone or autocoid, secreted by the islet tissue of the pancreas, which acts upon carbohydrate metabolism so as to prevent an undue accumulation of glucose in the blood."

Also Dorland, in the 1919 issue of the "American Illustrated Medical Dictionary," states as follows:

> "INSULINE (insu-line) L. *insula* (island of the pancreas). A hormone supposed to be secreted by the islands of Langerhans of the pancreas, which acts to prevent excessive accumulation of glucose in the blood."

A great deal of research has been confined to intravenous and intramuscular injections of liquid extracts made from various portions of the Pancreas. These injections, however, must be kept up continously if improvement is to be made, and, therefore, this method of administration has many objections. Continued injections tend to scar the tissue and produce necrosis of same. After some time, when rabbits are used as the test animal, if the fall in blood sugar be sufficiently great, characteristic symptoms follow: A preliminary hyperexcitability gives way to a comatose condition, the animal lies on its side, breathes rapidly and frequently dies. For these reasons the bulk of research is now being directed toward oral administration of the desiccated product, in conjunction with the use of retention enema and suppositories.

Therapeutic Indications:

The splenic or small end of the pancreas, otherwise known as Islands of Langerhans, is indicated in diabetes mellitus of pancreatic origin. It is also used for control of adrenal excess in high blood pressure of alimentary origin.

Counter Indications:

Diabetes of hepatic origin.

Adjuvants:

Duodenal tissue, and calves tonsils.

Preparations Available:

Suppositories containing twenty grains of desiccated I'lang-hans powder. Desiccated I'lang-hans powder for tablets, capsules and retention enema, ~~and I'lang-hans solution—a sterile solution of the active hormone.~~ 3/4/24

Dose:

Internally, five grains of desiccated I'lang-hans powder before meals, gradually increasing to ten or fifteen grains per dose as conditions warrant. As a retention enema, a teaspoonful to a pint of luke warm water. Suppositories containing twenty grains of I'lang-hans powder. I'lang-hans solution:

As this booklet goes to press the sterile solution is still a subject of research. Dosage not as yet determined.

PARATHYROID GLAND

Source and Parts Used:

The parathyroid glands are obtained from cattle. As the name indicates, they lie beside the thyroid and have been considered by some an accessory thyroid.

Anatomy and Physiology:

These glands are embedded upon the trachea or upon the surface of the lateral lobe of the thyroid gland. In structure the parathyroids are composed of solid masses of ephithelial cells arranged in a more or less collumnar fashion with numerous intervening capillaries.

The parathyroid gland is one of the most interesting of all the endocrines. It is directly concerned with the maintenance of a sufficient amount of calcium in the tissues. It is claimed that when the internal secretion of the parathyroid is impaired muscular spasms and tremors result caused directly by loss of calcium from the blood.

Therapeutic Indications:

The internal secretion of the parathyroid is indicated in paralysis agitans. Often times the lack of parathyroid secretion and activity has been traced to the accidental injury or removal of the gland in operations on the thyroid. Certain forms of epilepsy are caused by the absence or reduction of the calcium content of the blood, producing cerebral irritation; and in such cases desiccated parathyroid in combination with calcium salts is indicated.

The parathyroids are said to control calcium metabolism, teeth, bones, etc. They contribute to the maintenance of muscular tone and muscular irritability.

Adjuvants:

Bile salts, orchic substance, ovary and hepatic substance, together with brain, spinal cord and calcium salts.

Preparations Available:

Desiccated powder, one part of which is equivalent to six parts of fresh tissue.

Dose:

The average dose is one-tenth of one grain once or twice daily.

THE PINEAL GLAND

Source and Parts Used:

The pineal gland is usually obtained from beef, although some glands are obtained from sheep. The total gland is used and it requires about five thousand cattle to produce one pound of desiccated gland.

Anatomy and Physiology:

The pineal gland is a small reddish gray, pea-sized vascular body situated in the skull near the base of the brain. It is shaped like a cone, hence the name, pineal, (pinus, a pine cone).

It secretes an active principle or "hormone" which controls mental development. The discovery of this gland came about through a case of abnormal mental development in a child whose pineal gland had taken on an abnormal growth. The excessive action of the hormone caused the child's mind to develop so abnormally that at five years of age he reasoned as would a young man. This abnormality gave the clue for the administration of pineal extract in the treatment of mentally deficient children. During early life it influences nutrition, including the development of the genital organs, deposit of fat, as well as general growth and mental processes. In the aged it promotes natural mental activity and retards senility.

Therapeutic Indications:

Pineal gland is indicated in the treatment of mentally deficient children, as well as premature mental failure. Medical literature records, among many cases treated with this extract, that of a boy of seven years who had never said any connected intelligent words, and who had the habits and appearance of an imbecile. In two months' treatment with pineal gland (no other remedy being employed) the boy could understand and answer simple questions, and had acquired between fifty and one hundred words. It acts to retard the onset of senility. This gland, which experiments have been shown to accelerate the sluggish action of the brain of the retarded child, may also serve to arrest or delay certain cases of premature breakdown of the mental powers of the aged.

Preparations Available:

The desiccated powder (one grain of which is equivalent to about eight grains of fresh gland) administered in the form of tablets and capsules.

Dose:

One-twentieth to one-tenth of a grain orally three or four times a day between meals. Administration should continue over a long period.

THE PITUITARY BODY

Source and Parts Used:

The Pituitary body is a small, reddish gray, vascular body contained within the sella turcica of the skull. It is situated at about the center of the brain, within a bony cradle. For medicinal use it is usually obtained from cattle.

Anatomy and Physiology:

The pituitary body consists of two portions or lobes—the large anterior or oval, and the small posterior or cerebral division. The anterior lobe is derived as a diverticulum from the primitive oval cavity; the posterior lobe descends as an outgrowth from the brain, communicating the fetal life with the third ventrical. The stalk of this growth remains as the infundibulum.

Therapeutic Indications:

To better understand the activity of the whole pituitary body it seems advisable to consider each lobe seperately.

PITUITARY POSTERIOR LOBE

The secretion of the posterior lobe produces a hormone with activities resembling in some respects that obtained from the medullary portion of the suprarenal capsule, although chemically and physiologically different. There are two products marketed:

(a) The desiccated powder, one part of which is equivalent to six parts of fresh posterior lobe.
The desiccated posterior lobe is said to control sugar tolerance and is possibly an important factor in salt and water metabolism.

(b) The Liquor Hypophysis (Liquid Pituitary) of the U. S. Pharmacopoeia, a sterile extract of the active principle of the posterior lobe. Liquor Hypophysis is administered subcutaneously to hasten labor after the second stage has commenced. Great care must be exercised in using the liquid in these cases, as much damage might result if the proper precautions are not observed.

Liquor Hypophysis is marketed in two strengths: Liquor Hypophysis, Obstetrical, and Liquor Hypophysis, Surgical, or double the strength of the Obstetrical. When either of these two liquids is injected hypodermically or intramuscularly, it causes—

(a) A prolonged rise in blood pressure.

(b) A slowing and strengthening of the heart beat.

(c) A marked increase in the secretion of urine, and increased peristalsis and contraction of the uterus.

Strange to say, it is recorded that removal of the active posterior lobe, as a rule, produces only slight ill effects, while removal of the at present considered less active anterior lobe eventually results in death.

Counter Indications:

Liquor Hypophysis, Obstetrical should never be used in the early stages of labor, as its action might cause rupture of the uterus. It is also counter indicated in nephritis, myocarditis, arterio sclerosis, contracted pelvis and high arterial tension.

Dose:

The dose of the obstetrical is five to fifteen minims (one-third to one cubic centimeters) hypodermically or intramuscularly. In labor use small initial dose and repeat at intervals of twenty to thirty minutes as symptoms indicate.

The dose of the surgical is one-half to one cubic centimeter by intramuscular injection immediately after or within three or four hours after operation. Dose may be repeated or increased as symptoms indicate.

The desiccated powder is given in one-quarter to one grain doses three or four times per day.

PITUITARY ANTERIOR LOBE

Therapeutic Indications:

The anterior lobe is said to control skeletal and muscular growth and phosphorous metabolism. Theoretically it should be of value in functional sexual impotence. It has been used with some success to promote growth in stunted conditions.

Adjuvants:

Thyroid, gonads.

Preparations Available:

The anterior lobe is marketed in the form of:

(a) A sterile solution for hypodermic use, and,

(b) A desiccated powder for oral administration, one part of which is equivalent to six parts of fresh tissue.

Dose:

One to four grains of the desiccated powder, orally, three or four times a day between meals.

One-half to one cubic centimeter of the sterile solution of the anterior lobe.

PITUITARY WHOLE GLAND

Therapeutic Indications:

Having considered the two seperate portions of the Pituitary body the indications for the desiccated whole gland can be considered. The most important indication is adipose genital dystrophy. This condition is due to a lack of secretion of the posterior as well as the anterior lobe, so the rational treatment is the administration of both lobes. It is also said to be responsible for the preservation of the memory deposit laid down in the brain.

Adjuvants:

Thyroid, gonads, thymus.

Dose:

The dose of the desiccated whole gland should be about six grains per day, taken one-half to two grains, orally, between meals and at bed time.

PLACENTAL SUBSTANCE

Source and Parts Used:

The Placenta of cows and sheep are principally used.

Anatomy and Physiology:

A round, flat organ within the uterus which establishes communication between the mother and the fetus by means of the umbilical cord. The placenta begins to develop immediately after conception and is thought to continue to secrete its hormone or internal secretion until it is separated from the uterine wall during labor.

Therapeutic Indications:

The placenta is supposed to inhibit the secretion of milk while preparing the breasts for such activity. Placenta extract is indicated in feeding to mothers whose breast fed infants do not thrive. In many cases the children improve immediately after administration. It has also proven successful in excess posterior pituitary activity, also in checking prolonged flow during menstruation. It also antagonizes placental toxemia and is therefore beneficial in vomiting of pergnancy. It is presumed to act by artificially establishing an immunity to the placental protein to which certain individuals are unusually sensitive.

Adjuvants:

Mammary gland, total pituitary body, thyroid gland.

Preparations Available:

Desiccated powder in tablets and capsules, one part of the powder being equivalent to eight parts of fresh substance.

Dose:

For nursing mothers the dose should be as large as fifteen to twenty grains a day orally; in other cases ten grains a day for two weeks before the expected menstrual period. For vomiting of pregnancy twenty-five grains a day for ten days is considered a complete treatment since expected results will come before this time if the hormone is going to be effective.

PROSTATE GLAND

Source and Parts Used:

Cattle are the animals from which these glands are obtained.

Anatomy and Physiology:

The male prostate gland surrounds the neck of the bladder and the urethra, and is shaped like a chesnut. It consists of a median lobe and two lateral lobes and is made up partly of glandular matter and partly of muscular fibre. The ducts from the glandular matter empty into the prostate portion of the urethra and the muscular fibres encircle the urethra. The Prostate gland furnishes an internal secretion which has an effect upon micturition. After removal of the prostate the activity of the testicles is affected.

Therapeutic Indications:

Desiccated Prostate gland is recommended in atrophy and diseases of the testicles, also in enlarged prostate.

Adjuvants:

Prostate substance is used in combination with testicular extract, lymphatic glands, thyroid and pituitary gland (anterior lobe).

Preparations Available:

The desiccated powder (one part of which is equivalent to about seven parts of fresh gland) in tablets, and capsules.

Dose:

Two and one-half to ten grains orally, gradually increased, twice or three times daily, after food.

SALIVARY GLANDS

Source and Parts Used:

The Salivary glands from cattle are used.

Anatomy and Physiology:

The Salivary glands are three in number, the Parotid, Submaxillary and Sublingual. Their best known function is the secretion of saliva and the production of the enzyme ptyalin. That these glands have an internal as well as external secretion is evidenced by the frequency of orchitis, ovaritis, pancreatitis, etc., which follow mumps.

Therapeutic Indications:

Parotid extract was originally used in the treatment of pelvic troubles in women, in ovaritis, dysmenorrhea, etc. It has also been recommended in cases where the menses are irregular, and there is considerable pain at the period. The clinical evidence regarding the use of the submaxillary and sublingual glands is very meager.

Adjuvants:

Ovary and mammary substance.

Preparations Available:

All three of the salivary glands, submaxillary, sublingual and parotid are available on the market in desiccated powder. Desiccated Parotid gland is also compressed into two-grain tablets.

Dose:

Two to eight grains of Parotid substance three times a day before meals, continued for some time. One part of the desiccated Parotid substance is equivalent to about seven and one-half parts of fresh gland.

Note:—Since desiccated ovarian and corpus luteum substances have been introduced in the treatment as recorded above, and have been proven much more effective, the parotid substance has been dispensed with unless used in conjunction with desiccated ovarian gland.

Submaxillary and Sublingual:

The clinical evidence regarding an internal secretion from these two glands is very meager and no dosage can be recommended.

SEMINAL VESICLES

Source and Parts Used:

The Seminal Vesicles are two lobulated membranous pouches placed at the base of the bladder. The vesicles of beef are the parts used.

Therapeutic Indications:

Little is at present known regarding the internal secretion of these vesicles—although some clinical data is being collected.

Preparations Available:

The desiccated powder from the seminal vesicles is procurable on the market. One part of the desiccated powder is equivalent to about eight and one-half parts of fresh vesicles.

Dose:

It is not possible at present to suggest a dose.

SPINAL CORD

Source and Parts Used:

The Spinal Cord from sheep and calves is used.

Anatomy and Physiology:

The nervous system is divided into two divisions, the cerebro-spinal and the sympathetic. To the cerebro-spinal belongs the spinal cord. It is the attenuated, nearly cylindrical part of the cerebro-spinal axis which lies in the vertebral canal. Spinal cord substance is closely allied with the brain and cranial and spinal nerves. Like the brain it contains lecithin as its principal ingredient. Lecithin has for many years been recognized as a very important substance in human metabolism. It is vital to nearly all animal cells, and particularly so to the nerve cells.

Therapeutic Indications:

Desiccated spinal cord is indicated in nervous and mental disorders, including depression, melancholia, hysteria, epilepsy, etc.

Adjuvants:

Desiccated suprarenal gland.

Preparations Available:

Spinal cord substance is on the market as the desiccated powder one part of which is equivalent to about six parts of fresh spinal cord; the powder is administered in capsules and tablets.

Dose:

One to three grains of the desiccated powder orally three or four times a day, between meals.

SPLEEN

Source and Parts Used:

The whole parenchymatous tissue from the Spleen of calves, sheep and pigs is used.

Anatomy and Physiology:

The Spleen is not a ductless gland in the true sense of the word; it is more correctly classified with the "haemolymph" series. It is one of the largest of the glands. It is of a deep reddish brown color, varies in size and is situated to the left of the stomach and below the diaphragm. Chemically the spleen is rich in iron and nuclein.

Therapeutic Indications:

Desiccated Spleen is said to bring about activation of the trypsin in the white blood cells, thus favoring phagocytosis; it is also said to activate tryptic digestion. Therapeutically, spleen insufficiency is usually the cause of severe forms of malarial toxemia. Desiccated spleen is used as an adjunct measure in malnutrition and pulmonary tuberculosis, with anemia and demineralization, (in such administration, however, the spleen substance influences nutrition rather than the actual control of the infective process).

Counter Indications:

Desiccated Spleen substance is counter indicated in shock.

Adjuvants:

Thyroid, liver, hemoglobin.

Preparations Available:

Desiccated powder, one part of which represents five parts of fresh parenchyma of the Spleen, in the form of tablets and capsules.

Dose:

Five to fifteen grains three to four times a day after meals.

SUPRARENAL GLAND (Adrenal)

Source and Parts Used:

The whole gland from cattle is the part used.

Anatomy and Physiology:

The suprarenal capsule or body is a small triangular organ situated, as the name implies, above the kidney. Structurally the suprarenal gland is divided into two parts, the cortex or external layer and the medulla or internal portion. From the secretion of the medulla the active principle, Epinephrin, is obtained. Epinephrin has established itself in surgery on account of its dependable hemostatic and styptic properties.

The internal secretion of the corticular layer has not as yet been isolated although much clinical work is being done on it. The separation of the two portions is practicable, and they are purchasable on the market.

The important functions of the whole superarenal body are:

To assist in sexual development, especially in the young,

To maintain muscular tone, and

To protect the individual against bacterial infection.

A plentiful suprarenal secretion ordinarily means a vigorous muscular and nervous constitution, one capable of much mental concentration and physical exertion.

The Medullary Portion is said to control emergency functions, such as the somatic responses in emotions, and the preparation for combat with all the specific reactions that it entails, such as the mobilization of sugar, the control of somatic and vascular blood supply, and the sensitization of sympathetic nerve terminals. It is the great sympathetic stimulant.

The Corticular Portion has an important function in growth and development of cerebral cortex. It plays a role in the development of the male sexual organs, and makes for masculinity.

Therapeutic Indications:

Desiccated Whole Suprarenal Substance is indicated in asthma and bronchial spasm, Addison's disease, cholera, Grave's disease, as well as collapse and shock during severe infectious diseases.

Adjuvants:

Liquor Hypophysis with Epinephrin Chloride Solution.

Preparations Available:

Desiccated whole suprarenal gland, standardized in accordance with the test laid down in the U. S. Pharmacopoeia IX, which requires that the powder contains not less than 0.4% nor more than 0.6% of Epinephrin (the active principle).

The desiccated powder is administered orally in the form of capsules and tablets.

EPINEPHRIN

Epinephrin is the physiologically active principle of the suprarenal medulla. It is classified with the alkaloids.

Therapeutic Indications:

Epinephrin is the most powerful vasoconstricting drug known, and is used locally for arresting capillary hemorrhage; especially in the eye, nose and throat.

Epinephrin Chloride solution 1:1,000 is very beneficial in bronchial asthma. Five to ten minims injected intramuscularly promptly arrests the asthmatic paroxysm. It is also applied locally as a spray to the larynx.

Dose:

The dose of the entire gland is one-tenth to one-fifth grain orally every hour in acute conditions, chronic conditions one or two grains three times a day.

The dose of the Epinephrin Chloride solution 1:1000 is from fifteen to thirty minims every two or three hours. Hypodermically, one to fifteen minims (injected intramuscularly) diluted with sterile water or preferably isotonic salt solution. For local application Epinephrin Chloride solution is used in dilutions varying from 1:1500 to 1:1000.

THYMUS GLAND

Source and Parts Used:

The total Thymus gland from either sheep or cattle is used.

Anatomy and Physiology:

The Thymus gland secretes an internal hormone which is most directly concerned with physical growth. This gland is located in the chest in front of the trachea and over the top of the sternum.

In the human being the following conditions are found:

Normally the thymus gland attains its largest size in early childhood, becoming atrophied in the adult. It not only stimulates the growth of the child but also seems to have a retarding influence over the maturing of the functions that distinguish the adult from the child. Under normal conditions the thymus retrogresses with the onset of puberty, and in fact it is only thru such retrogression that puberty is possible. It is the gland of childhood and is the gland which "keeps children, children," and whose active hormone prevents them from maturing too rapidly. If examined when its growth is most active it will be found to consists of two lateral lobes placed in close contact along the middle line. The two lobes generally differ in size and are occasionally united to form a single mass; and again separated by an intermediate lobe. The thymus is of a pinkish-gray color, soft and lobulated on its surfaces.

Therapeutic Indications:

Desiccated thymus gland has been used in malnutrition, delayed development in children, and whenever there is disturbed metabolism, exophthalmic goiter, chronic joint disturbances, and kindred conditions. Also used in treating lymphatic disorders. Thymus is especially rich in nucleic acid and is in fact one of the large sources for this product. Nucleic acid increases the number of leucocytes in the blood, and hence under favorable circumstances the disease-resisting power of the body. It is prescribed in anemia, general delibility, septicemia, etc.

Counter Indications:

Possibly gout, uric acid diathesis, and similar conditions.

Adjuvants:

In tubercular or lymphatic diseases, calcium salts; in Grave's disease anterior pituitary, thyroid and gonads.

Preparations Available:

Desiccated powder, one part of which is equivalent to about seven parts of the fresh gland. The powder is administered in the forms of capsules and compressed tablets.

Dose:

Four to eight grains orally three or four times a day, about an hour after meals. Dosage should be gradually increased and continued over a long period of time.

THYROID GLAND

Source and Parts Used:

Desiccated Thyroid (Thyroideum Siccum) is recognized in the United States Pharmacopoeia. Thyroids of young sheep, also some hog and beef thyroid glands are used.

Anatomy and Physiology:

The Thyroid gland is located in the throat in front of the trachea, and consists of two lateral lobes, connected centrally by an isthmus. The organ is composed of follicles lined by epithelium, producing a peculiar colloid material. Desiccated thyroid gland is official in the U. S. Pharmacopoeia which standardizes it to a content of from .17% to .23% Iodine.

The internal secretion of the Thyroid probably exerts a greater influence upon the general well-being than any of the other endocrines. Upon it depends the whiteness of the teeth, the distribution of hair, the moisture of the skin, the distribution of fat, the stability of the mind, the development of sexual functions, the speed of protein metabolism and the elimination of toxic proteid waste, especially bacterial.

The thyroid is so intimately associated with the sex glands, especially the ovaries, that it has been termed an "accessory ovary." It is considered impossible that a woman can possess a normal ovarian development and function without a sound thyroid. An increased secretion of the thyroid is always associated with an increased rate of metabolism, with alertness, moist skin, with no obesity or puffiness. When the increase goes beyond the limits of safety we find tremors, exophthalmos, and enlargement of the thyroid. It is natural, then, during pregnancy, when an increased nutrition and metabolism are called for, that the internal secretion of the thyroid be increased. If it fails, for any reason, the woman develops signs of toxemia, the teeth decay, the hair begins to fall out and the nails become brittle. In decreased secretion, especially in children, imperfect physical and mental development results.

Desiccated thyroid is said to control the speed of growth. It is the great vagotonic stimulant. The thyroid type of woman is a highly neurotic and emotional one.

Therapeutic Indications:

Desiccated thyroid gland is indicated in cases of myxedema (loss of the thyroid function), in which the body seems to be bloated, accompanied with nervousness, tetany, skin annoyances, langour and drawling speech.

Cretinism (obliterated thyroid), in which the child is under-developed and mentally deficient.

Sterility, delayed puberty and amenorrhea, circulatory instability (cold extremities), chronic rheumatism and arthritis, menstrual disorders, nocturnal incontinence, etc.

Counter Indications:

Hyperthyroidism, cardiac instability, extreme nervousness, etc.

Adjuvants:

Thyroid extract in small doses has proven very valuable, therapeutically, when combined with many of the other endocrines such as the thymus, pituitary, ovaries, etc. Iodides administered with thyroid frequently accelerate its therapeutic efficiency.

Preparations Available:

Desiccated Thyroid U. S. P. standardized on the basis of its organic iodine content is administered in the form of capsules and tablets.

Dose:

Authorities agree that the dosage is variable, depending upon the patient. One-tenth to two grains four or five times in twenty-four hours is said to be the average maximum range. In all cases the preparation should be given in doses that are well tolerated, and it should be remembered that careful attention to dosage is as important as the actual administration.

TONSILS

Source and Parts Used:

Tonsils of calves (as well as other young animals) are the parts used.

Anatomy and Physiology:

The tonsils are two small, almond shaped bodies situated one on either side of the fauces, between the anterior and posterior pillars of the soft palate. The tonsil consists of an aggregation of from ten to eighteen lymph-follicles and is covered with mucous membrane. The tonsil secretes mucous externally which serves to moisten the throat. The internal secretion is said to temporarily reduce blood pressure and increase both the red and white blood cells.

Therapeutic Indications:

Calves and beef tonsils in desiccated form have been used by some investigators as an aid in the treatment of diabetes; by others in catarrhal conditions.

Adjuvants:

Desiccated Islands of Langerhans of the pancreas and Secretin are used in conjunction with calves' tonsils in the treatment of diabetes mellitus.

Preparations Available:

Calves' Tonsils are purchasable on the market in desiccated form. One part of the desiccated gland is equivalent to six parts of fresh tissue.

Dose:

Two to five grains three times a day before meals.

DIGESTIVE ENZYMES

DIGESTIVE ENZYMES

The Digestive Ferments or Enzymes exert a marked effect upon the metabolism of both plants and animals. Their very existence has been known only for a few decades, and yet some of the most important changes of nature are due to their activities. You cut yourself, the blood starts to flow and would all run out of your body as water does from a leaky barrel if it were not for the enzyme Thrombase, which causes the blood fibrin to coagulate upon contact with the air. You add an enzyme, Rennet, to milk in the proportion of 1 part of enzyme to 800,000 parts of milk and you perform the first step in the making of cheese. Again without enzyme action there could be no butter fat; in short, it is true that enzyme activity in nature is not only necessary to build up the important bodies upon which we subsist, such as starch, sugar, albumin, meat, etc., but enzyme activity is equally necessary to break them down and assimilate them.

These enzymes are peculiar for the most part solely to themselves. Their reactions are the result of what we term catalysis, that is, contact; they do not enter into the reaction, neither are they used up, but by their mere presence set in motion a reaction between two other substances. They are probably the most delicate and sensitive class of agents known, requiring, as they do, special care not only during the process of isolation but also in their combinations in commercial forms, and in their subsequent use. No chemical formulae have been assigned to them since they have never been secured in a state of absolute purity. It is questionable whether they consist of matter or force; if they are matter, they are probably of proteid character or are closely related to the proteins.

The two important Digestive Enzymes are Pepsin and Pancreatin

PEPSIN

Nomenclature:

The enzyme Pepsin is officially recognized in the Pharmacopoeias of the United States, Germany, France, and England under the title Pepsinum, in Japan under Saccharated Pepsin, while the fourth edition of the National Formulary describes many liquid combinations of the enzyme.

Source:

Pepsin is the proteolytic ferment obtained from the glandular layer of the hog stomach.

Description:

Pepsin occurs in pale yellow or yellowish, almost transparent granules or spongy masses; or as a fine, white or cream colored, amorphous powder, free from any offensive odor and having a slightly acid or saline taste.

Properties:

Pepsin is not more than slightly hygroscopic, it is brilliantly and completely soluble in water and 15% alcohol. A good test for solubility is the proportion of one gram Pepsin to ten cubic centimeters of either water or 15% alcohol.

The official strength of pepsin is recognized in the U. S. P. as 1:3000, but the trade now demands pepsin assaying from two to three and even more, times this official strength. A 1:6000 or a 1:10,000 spongy granular pepsin is much preferred to the 1:3000 because of various reasons.

It is a more highly purified product, due to its containing less inert diluent.

A proportionally less quantity of the 1:6000 and 1:10,000 is used than is required of the 1:3000.

Due to the method of vacuum drying the residual moisture in the granules is reduced to a minimum. This improves the solubility by making the granules much more quickly and completely soluble. It also eliminates the danger of contamination with fine particles of glass such as sometimes happens by the old process of drying on glass at atmospheric pressure.

Therapeutic Indications:

Pepsin is extensively employed for the purpose of substituting the natural digestive ferments in cases where the digestive powers of the stomach have failed. It is also used in the peptonizing of milk for infants and for digesting false membranes in diphtheria. It has proven very efficacious in administration to infants having feeble digestion. In infants six months and more of age suffering from indigestion and diarrhoea, one-half grain of 1:6,000 or one-third grain of 1:10,000 may be given after each feeding with almost unfailing benefit. Pepsin 1:6,000 or 1:10,000 may be administered with good results after a prolonged illness, in conjunction with dilute hydrochloric acid.

Incompatibilities:

In administering Pepsin, and the other enzymes as well, it is very important to avoid subjecting them to any condition which materially retards, inhibits or destroys their action. One important consideration must be remembered, however, and that is that most of our conclusions have been based upon external or laboratory tests, outside the stomach.

In laboratory tests alcohol retards peptic activity, but authorities agree that alcohol is quickly absorbed in the stomach, leaving the ferment free to act. An alkaline solution quickly destroys pepsin outside the stomach, but in the stomach the alkali is quickly neutralized and its inhibitant action reduced. Pepsin and sodium bicarbonate are incompatible in laboratory test, yet many physicians prescribe Pepsin and Soda Mint tablets with excellent results; so it seems that once "Nature" gets hold of the enzyme she immediately proceeds to protect it.

Pepsin, being a proteolytic digestant, breaks down proteids, such as beef and egg albumen, into intermediate compounds approaching the peptone stage. It is selective in its activity as to the nature of the proteid acted upon; the temperature at which the action takes place and the reaction of the menstrum; 52°C. (or 125° F.) and approximately 0.3% hydrochloric acid solution in water are the proper conditions for maximum peptic activity.

Associated with the property of pepsin to digest proteids is its power to coagulate milk and authorities are not agreed whether it exists as one ferment or a combination.

Preparations Available:

Pepsin is marketed in the form of spongy granules and powder in the strengths of 1:3,000, 1:6,000 and 1:10,000, these in turn being incorporated in an extensive list of liquid products; as capsules, tablets, lactated pepsin, saccharated pepsin and pepsin glycerole 10% and 20%.

Dose:

When it is considered that these digestive enzymes are neither drugs nor chemicals, it is readily seen that there are no fixed doses, nor overdose. Five to seven and one-half grains of the 1:6,000 or 1:10,000 three times daily, in solution, granules or powder is a good average dose.

PANCREATIC ENZYMES

Nomenclature:

Pancreatin is official in the Pharmacopoeias of the United States, France (Pancreatine), and Spain (Pancreatina). Its Latin name is Pancreatinum. In Germany it is not official, but is familiar (Pankreatin) to physicians and pharmacists.

Liquor Pancreatis is the only preparation official in the British Pharmacopoeia.

Source:

Pancreatin, as it occurs commercially, obtained from the pancreas of pigs or cattle, contains one or more of the three pancreatic enzymes, Amylopsin, Trypsin and Steapsin. Some observers have claimed to isolate a milk curdling enzyme, similar to gastric rennin.

The methods of extraction vary greatly, according to the nature of the fresh glands, the practices of the individual manufacturers, and the particular enzyme desired.

Description:

Pancreatin is found on the market chiefly in the form of an amorphous powder, light cream to yellow in color, varying in fineness, of faint animal or meaty odor and taste, but not disagreeable. It is partially soluble in water, insoluble in alcohol, ether and chloroform.

Properties:

Pancreatin is rendered inert by high degrees of heat; its action is inhibited by acids, or strong alkalies, strong alcohol, etc. In the dry form it is practically permanent, but in solution it tends to deteriorate; glycerin or alcohol is commonly used to properly preserve pancreatic solutions. Pepsin and pancreatin cannot be active in the same fluid, because the former requires acidity and the latter alkalinity.

Although laboratory tests outside the system show that one ferment destroys the other, depending upon the reaction of the menstrum, when present in the same fluid, yet the prescribing of the two enzymes in dry form is not only compatible but to be recommended. Some elaborate experiments conducted on the assumed destruction of Trypsin by Pepsin and Acid showed, in observations upon animals, that in all the experiments the pancreatic ferment persists through the acid incubation, provided this acid is sufficiently bound by protein to bring the hydrogen-ion concentration down to certain values.

This fact also has an important bearing upon the question. "Is Pancreatin efficient when administered by mouth?" The conclusions are that trypsin or pancreatin, when given in relatively large amounts, and in the presence of protein, possesses the degree of resisting power requisite to maintain its activity and when it eventually passes the stomach and reaches the duodenum, where it is normally active, it immediately starts proteolytic digestion as if it had never been subjected to the action of the acid and pepsin of the stomach.

The chemistry of Pancreatin, like that of other enzymes, is very little understood. No formula can be assigned to it, and there is no method of identifying it by analysis; the assay methods are based on its starch and proteid digesting power. It is of coarse rich in nitrogen, while the ash is quite variable, according to methods of manufacture.

Pancreatin of commerce is usually sold to meet the United States Pharmacopoeia test for amylopsin, or as usually termed the "Starch Test." The so-called "Milk Test" or test for tryptic power is very indefinite and seldom used.

A description of the three most important enzymes follows:

Amylopsin or Diastase

By special treatment of the pancreas a ferment can be obtained with a starch converting power much higher than any official standard. Such a product is usually designated either as "Amylopsin" or "Diastase."

Strictly speaking the term "Diastase" is applicable to amyloptic enzymes of any origin, and hence to avoid confusion it is wiser to add a qualifying phrase as "from pancreas," "from malt," etc.

Commercially the terms are generally used with reference to an enzyme of greater potency than pancreatin. Such products are less likely to contain diluents, but in other respects resemble pancreatin powders. In the United States they are usually assayed by the method prescribed officially for Pancreatin, but in other countries both the assays and the definitions vary according to the respective Pharmacopoeias.

Trypsin

The proteolytic enzyme of the pancreas is Trypsin, and it is supposed to be present in U. S. P. Pancreatin to such an extent that it will peptonize milk under the conditions specified. Trypsin may be obtained from pancreas, by special process, in concentration much in excess of the Pharmacopoeial standard; it shows its activity on various proteids under conditions favorable to its action. The Fuld-Gross test is a satisfactory method for estimating tryptic strength.

Physical properties of trypsin are similar to pancreatin, but of course it has never been isolated in pure enough form to analyze it or assign a chemical formula.

When sweetbreads are treated especially to obtain trypsin, the resulting product has practically no other enzyme activity. It is not official in any Pharmacopoeia as yet, although the French Codex prescribes a tryptic test for Pancreatin on fibrin.

Steapsin

The lipase or fat-splitting enzyme of the Pancreas is known as Steapsin but it is seldom present to any marked degree in Pancreatin of commerce, nor is it stipulated in any official standard. By special methods of treatment Steapsin may be isolated so as to manifest considerable power in degrading fats and oils.

Steapsin of high strength is usually proportionately feeble or lacking in other enzyme action. In physical properties it is quite similar to Pancreatin while its chemistry is practically not known at all.

Therapeutic Indications:

Pancreatin is indicated in cases of gastro-intestinal indigestion in adults and children. In such cases it is used either for the preparation of artificially digested foods to be taken orally or in the form of nutritive enemata; or the pancreatin may be added to milk for the bottle fed child, or other liquid nutriment for the invalid, at the time of feeding.

Pancreatin, therefore, is used in medicine for the purpose of aiding a torpid or abnormal pancreas to deal with the food which is ingested.

No matter how it is used it is customary to prescribe sodium bicarbonate at the same time.

Pancreatin peptonizes milk, beef and oysters; also saccharifies the various farinaceous foods such as arrowroot, cornmeal, oatmeal, barley, wheat, etc.

Incompatibilities:

High heat, strong acids and strong alkalies inhibit the activity of pancreatin.

Preparations Available:

Pancreatin U. S. P. IX, 1:25, Glycerole Pancreatin, Amylopsin or Pancreatic Diastase 1:100, Trypsin, Steapsin, Peptonizing Powder.

Dose:

The dose of Pancreatin is seven and one-half to fifteen grains before meals; of the purified enzyme about five grains. For the preparation of artificially digested foods use a sufficient quantity.

RENNIN

Nomenclature:

Rennin is not official in any Pharmacopoeia, but in the N. F. III, a Liquid Rennet is described under the name of Liquor Seriparus, and in N. F. IV, Part II, Rennin is described and a test given. Rennin is synonymous with "Chymosin," first used by Deschamps, and "Lab," suggested by Hammarsten. It is generally classed among the true enzymes and is characterized by its peculiar property of coagulating milk. Used for ages in the preparation of cheese, rennin as such, or the nature of its action, was not known until Hammarsten's investigations.

Source:

Rennin of pharmacy is derived from the fresh or dried mucous membrane of the fourth stomach of suckling calves. This stomach is known as the "rennet."

Description:

It is usually in the form of powder

or granules, white or grayish in color, of faint animal odor and taste. It frequently tastes also of common salt or milk-sugar; the salt is a residue from certain processes of manufacturing, while milk-sugar is added to effect a granulation or to standardize to definite strength. Rennin destined for the making of cheese is usually offered in liquid form, with salt and boric acid as preservatives. It is known as Rennet Extract.

Properties:

Rennin is soluble in water, insoluble in alcohol, ether and chloroform. Chemically it is difficult to classify, because like other enzymes no formula can be ascribed to it. It is identified, therefore, only by its peculiar physiologic behavior with milk. Its activity is manifested in solutions that are neutral, or faintly alkaline or acid, but most observers agree that with an acidity of 0.185% one obtains more concordant results in assaying. The optimum temperature is 37° to 40°C. Its precipitation of casein depends upon the presence of calcium in the milk. The enzyme is quite permanent in dry form. Commercial Rennin is usually acid in reaction. There has been much discussion whether or not rennin is in reality a separate ferment, or identical with pepsin.

Incompatibilities:

The activity of Rennet is destroyed by alcohol, strong acids or alkalies, or heat above 50°C. The test prescribed in N. F. IV will not give uniform results, unless precautions are taken to use milk of known quality, standardized to a definite acid percentage of 0.185%, calculated as acetic acid.

Therapeutic Indications:

Rennin in pharmacy is mostly used for the preparation of junket tablets. Its use in the preparation of the junket is based upon the fact that the coagulation of milk by means of Rennet produces a fine flocculent curd, very easy to digest. This differs markedly from the acid curd of difficult digestion produced by the acid of the gastric juice.

Rennet is used in very great quantities in Essence of Pepsin and other liquid digestive mixtures. By far the largest consumption of rennin is in the cheesemaking industry. Ice cream manufacturers are also using Rennet in the manufacture of an ice cream mixture. It makes a smooth velvet ice cream.

Preparations Available:

Rennin, in the form of both powder and granules, is found on the market. It can be purchased both with and without salt and of a strength varying from 1:30,000 in six minutes to 1:30,000 in twelve minutes.

The average milk gallon is assumed to weigh 60,000 grains, hence a rennet termed 1:30,000 in six minutes means that one grain will coagulate 30,000 grains or one-half gallon of milk in six minutes.

DIASTASE—FROM MALT

Nomenclature:

Malt Diastase is official in the United States Pharmacopoeia under the title Diastasum, in the French Codex under the title "Diastase de l'Orge Germe."

Source:

Malt Diastase is obtained from barley by a process of germination.

Description:

Diastase of Malt occurs as a yellowish white amorphous powder, having a peculiar malt odor and flavor. It converts starch into dextrin and maltose.

Properties:

It is incompletely soluble in water and almost insoluble in alcohol. It gradually deteriorates on keeping and the amylolytic power is destroyed by heating the solution above 85°C. or by the addition of much acid or alkali.

Prepartions Available:

Malt Diastase is therapeutically indicated where an amylolytic digestant is required. Commercially it is used for the desizing of cloth.

Therapeutic Indications:

There are two common Malt Diastases on the market, one rated as 1:50 in thirty minutes, the other as 1:10 in ten minutes.

Dose:

Eight grains or more orally during meals.

INVERTASE

Nomenclature:

Invertase is not official in any of the Pharmacopoeias, and it is not used internally.

Source:

This enzyme is found widely distributed in the vegetable and animal kingdom, being secreted by all living cells where sucrose undergoes metabolism. It is probably best obtained from yeast.

Description:

Dry Invertase consists of a white powdery substance easily soluble in water. In common with the other enzymes the chemical composition of invertase is not fully known. Most invertase of commerce is in the form of a solution.

Properties:

This enzyme has a special affinity for sucrose or cane sugar, and under the proper conditions of temperature and reaction changes or inverts sucrose into a mixture of glucose and fructose. In common with other enzymes it does not itself enter into the reaction but acts merely as a catalyst. It has been found that a preparation of invertase which had already inverted 100,000 parts of sucrose, had lost none of its activity.

The big advantage in the use of this ferment is to the cane sugar manufacturers in the South. It is possible by inverting the cane syrup with invertase to produce a syrup which can be concentrated to 75% solids without danger of the sugar crystallizing out from the syrup, and at the same time this heavy density permits the keeping of the syrup without fermentation.

Cane sugar inverted by Invertase is also used in the making of candy. When used for candy it prevents the cane sugar from graining, especially in stick candy.

Inverted cane sugar is used as a soft filler for cakes and cookies, for it does not grain or crystallize; Invertase is also used in the manufacture of invert sugar.

Therapeutic Indications:

Invertase is not used in medicine, commercially it is used as above described.

Incompatibilities:

In common with the other enzymes invertase is gradually killed at a temperature above 55°C. Alcohol and alkalies also have a destructive influence.

Preparations Available:

Invertase in solution is the common form and there are two grades. The solution for "Cane Syrup and Invert Sugar," and the solution for "Analytical Use." The solution for analytical use is a highly purified solution recommended for all analytical purposes where quantitative estimations of sucrose are desired.

PTYALIN

Nomenclature:

Ptyalin is not official in any of the Pharmacopoeias.

Source:

Ptyalin is an amylolytic ferment obtained from the salivary glands of pigs.

Description

It is a yellowish powder, free from any disagreeable animal odor.

Properties:

Ptyalin or salivary diastase is partly soluble in water, insoluble in alcohol.

Therapeutic Indications:

Due to its weaker diastatic activity this enzyme is rarely used except in specialized cases. It is sometimes administered in dyspepsia, also for the conversion of starch into dextrin and maltose.

Incompatibilities:

Strong acids and alkalies are detrimental to the activity of ptyalin.

Dose:

Ten to thirty grains and more with meals.

SECRETIN

Nomenclature:

Secretin is not officially recognized in any of the Pharmacopoeias.

Source:

The normal, healthy glandular layer and mucous lining of the duodenum contains two hormones, prosecretin and enterokinase.

Description:

Secretin occurs as a light cream powder, insoluble in alcohol, and not completely soluble in water. It is free from any offensive odor.

Properties:

Prosecretin (which is converted into active secretin by the action of the hydrochloric acid of the stomach) and enterokinase possess neither diastatic, proteolytic or fat splitting properties and their chief function is to stimulate the pancreas and activate its secretion. It is also assumed that secretin excites the secretion of bile by the liver cells and the secretion of intestinal juice by the glands of the intestines.

Therapeutic Indications:

Secretin is recommended in the treatment of intestinal disorders where an increased flow of pancreatic, hepatic and intestinal secretion is desired. It is of special value in impaired proteid digestion. Secretin has also been recommended as an activator for the pancreatic hormone used in the treatment of diabetes.

Preparations Available:

The hormone in desiccated form.

Dose:

Two to four grains given while eating.

PROTEIN COMPOUNDS

BEEF EXTRACT—PHARMACEUTICAL

Nomenclature:

Beef Extract is mentioned in the United States Pharmacopoeia; it is official in the British Pharmacopoeia as "Extract of Beef," in the French Codex as "Extrait de viande, Extrait de boeuf," and as "Fleischextrakt" in the German book.

Source:

The strained concentrated water soluble constituents from fresh, lean beef, in the form of a semi-solid mass.

Description:

Extract of beef is a semi-solid mass of a brown color, usually somewhat granular, with a pleasant odor suggestive of roasted meat, and a characteristic, distinctly saline taste.

Properties:

It usually contains about 20% to 22% moisture. The ash is variable and runs from about 6% to 20%.

Therapeutic Indications:

Beef Extract is used extensively in the preparation of soups. It acts as a stimulant, but possesses very little nutritive properties. In addition to its use in soups it has also been extensively used in medicinal liquid preparations such as Beef, Iron and Wine, etc. Today, however, for the preparation of Beef, Iron and Wine and similar liquids, Beef Peptone, either paste or powder, is much prefered.

BILE PREPARATIONS

Nomenclature:

Bile and its derivatives have a well established place in modern medicine, yet they find little official recognition. Fresh Ox-bile is included in the U. S. P. IX (Fel Bovis) and the French Codex '84 (Bile de Boeuf, Fiel de Boeuf, or Amer de Boeuf). **Purified** oxgall was official in the U. S. P. VIII (Fel Bovis Purificatum), and in British Pharmacopoeia (Fel Bovium Purificatum). Oxgall Extract is official in U. S. P. IX (Extractum Fellis Bovis), and Inspissated Oxgall is official in the Japanese Pharmacopoeia, 3rd edition (Fel Tauri Inspissatum). The German for Oxgall is Ochsengalle or Rindsgalle.

In addition to the above official products there are other derivatives widely used in pharmacy, such as Powdered Oxgall, Powdered Purified Oxgall, Sodium Choleate, Sodium Glycocholate, Sodium Taurocholate, Bile Salts Compound, Hog Gall, etc.

Source:

Bile or Gall is a secretion from the liver deposited in the gall bladder as a sort of reservoir; from the gall bladder it passes to the intestines to take part in certain phases of digestion.

Description:

Fresh Bile contains two chief classes of characteristic solids, commonly known as "Bile Salts" and "Bile Pigments." The former include the sodium salts of glycocholic and taurocholic acids, which are well known chemical entities, and are regarded as the principal medical agents in bile; the latter include the familiar bilirubin, bilifuscin, biliverdin, and some other more obscure pigments. Bile also contains minute amounts of cholesterin, choline, urea, fats, and inorganic substances. Inspissated and powdered Oxgall contain practically all the ingredients above mentioned, while the other derivatives are prepared with a view to eliminating certain of the insoluble and unessential portions.

Inspissated Oxgall is fresh bile from the ox concentrated to a thick heavy paste of about 75% solids. It formerly was prepared in large quantities, but it is difficult to handle and is now largely supplanted by the dry preparations.

Fel Bovis Purificatum, Purified Oxgall, or Pilular Oxgall, was included in the U. S. P. VIII, but was omitted from U. S. P. IX. It was especially treated with alcohol to give a soluble product but the demand for it has considerably diminished.

Desiccated or Powdered Oxgall represents fresh bile taken to dryness, sometimes pure, but more often with an excipient. The nature of the excipient depends upon the character of the preparation in which it is to be used. Without such excipient, the powdered gall is hygroscopic and difficult to keep and to handle. For tablet manufacturing, powdered Oxgall is found on the market with such excipients as lactose, sugar, starch, talc, chalk, etc.

The color varies from buff to greenish, depending upon the method of concentration, drying, powdering, and the diluent used. It is very bitter to taste and has a peculiar odor. It is partly soluble in water with deep coloration, very slightly soluble in alcohol, and gives characteristic tests for bile acids and bile pigments. It yields an average ash residue of from 12% to 15%, and nitrogen of 2% to 3%.

Desiccated Purified Oxgall represents the pilular article of the U. S. P. VIII, taken to dryness, either with or without a soluble excipient. It is lighter in color than powdered Oxgall, varying from cream to buff, less hygroscopic, soluble in water and alcohol with moderate coloration, bitter-sweet to taste, ash 13% to 15%, and responding to the test for bile acids and pigments. The article called sodium choleate, as commonly found in the market, closely corresponds in properties to powdered purified Oxgall.

Powdered Extract Oxgall, U. S. P. IX, represents fresh bile purified by alcohol and taken to dryness with the addition of a sufficient quantity of dried corn starch. The amount of corn starch added varies with the percentage of moisture as well as the amount of impurities in the bile. The color may vary from a light yellowish cream to a light yellow. It represents practically a mixture of various bile ingredients contaminated with traces of fatty and soapy substances, in addition to corn starch, which is added to prevent caking of the powder.

Sodium Glycocholate and Sodium Taurocholate exist in bile to the extent of about 3% each and are derived by chemical processes which result in fairly distinct products commercially. In the pure form, however, they are crystalline and quite unstable in the presence of moisture. In a moist atmosphere the crystals are exceedingly hygroscopic and assume a fluid form.

Sodium Glycocholate chemically contains C, H, Na, N, and O, and crystallizes under ether in characteristic form. As found on the market it is a cream or buff colored powder, quite hygroscopic, soluble in water and alcohol, and usually contains a certain amount of taurocholate.

Sodium Taurocholate chemically contains the same elements as glycocholate, with the addition of sulphur; by means of a quantitative estimation of the sulphur content the purity of the taurocholate may be estimated. It occurs on the market as a cream or buff-colored powder, quite hygroscopic, soluble in water and alcohol, and usually containing a certain amount of glycocholate.

Bile Salts Compound or **mixture** is a term given to several powdered derivatives of oxgall on the market, for which there is no accepted standard. For the most part they represent a powder for tablet manufacture which contains a minimum of 65% sodium glycocholate and sodium taurococholate, with the addition of a sufficient quantity of starch to free them from the undue hygroscopicity of the pure salts. They are soluble in water and 25% alcohol, light buff in color, and otherwise share the characteristics of bile derivatives.

Physiology:

Although the bile is secreted in the liver and stored in the gall bladder, yet its function is exerted in the upper intestine, where it co-operates with the pancreatic and duodenal fluids, and plays an important part in the emulsification of fats, and the homogenization of waste. The bile pigments give color to the stools. It is possible that bile is a factor in maintaining a certain balance of saprophytic bacteria in the intestine, which is equivalent to an antiseptic action against pathogenic organisms.

Therapeutic Indications:

The chief medicinal virtue in Oxgall seems to lie in the bile salts, and therefore a rational therapy should recognize the value of the salts themselves in as pure a form as practical. Experimentally, the bile salts are known to cause severe reaction, mostly depressive, of the heart and nervous systems, when injected into the circulation. Given by mouth, they produce an antiseptic and aperient action in the intestines, especially in conjunction with hydrogogue cathartics, and they assist in the hydrolysis and absorption of fats. They probably exert a beneficial effect on the liver, stimulating the flow of bile, and helping to deplete engorged hepatic cells, and to promote normal biliary peristalsis. They are prescribed for all sluggish conditions of the hepatic and biliary systems, including jaundice, calculus, fistula, congestion and cirrhosis.

Dose:

Extract Oxgall U. S. P. IX, one and one-half grains; purified Oxgall U. S. P. VIII, seven and one-half grains; Sodium Glycocholate and Taurocholate, one to five grains each; Bile Salts Compound, five grains.

BLOOD PREPARATIONS

HEMOGLOBIN

Source:

Hemoglobin, representing the largest portion of the colored corpuscles, is obtained from the red blood cells of cattle. The red blood cells are desiccated under vacuum with delicate temperature control and the dry material is either sold in the form of scales or powder.

Description:

Hemoglobin is purchasable either as dark brown, lustrous, odorless scales or a brownish red powder.

Properties:

Hemoglobin is a variable histone-like globulin called globin, combined with about 4% of a non-albuminous iron containing pigment of constant composition called hematin. Hemoglobin is to the animal what chlorophyll is to the vegetable kingdom. It is through the agency of hemoglobin that the tissues of animals are supplied with the metabolic and life-giving oxygen. The molecular formula of hemoglobin is extremely complex. Due to its great affinity for oxygen, hemoglobin passes in the arterial blood, into oxyhemoglobin.

In the stomach, hemoglobin is changed to hematin, and experiments have proven that both hemoglobin and hematin are absorbed and lead to an increase in the hemoglobin content of the blood.

Hemoglobin is soluble in water, decomposed by extremely small amounts of acids, coagulated at 64°C., and is dextro-rotatory. It cotains about 0.5% of its weight of Iron as Fe_2O_3, and it is doubtless due to the presence of this metal that its quick alternate oxidation and reduction depends. It does not give the characteristic iron reaction until decomposed.

Therapeutic Indications:

Hemoglobin has for years been recognized as a hematinic and a readily absorbable constructive tonic. Due to its content of iron in organic combination, it is valuable in the treatment of anemia, chlorosis, debility, etc.

Dose:

It is usually administered in doses of seventy-five to one hundred fifty grains in wine or syrup.

WHOLE BLOOD

(Desiccated)

Source:

The whole blood from cattle, desiccated under vacuum and powdered.

Description:

It is marketed in the form of a dark, reddish brown powder.

Properties:

Desiccated whole blood is incompletely soluble in water, insoluble in acids and alcohol.

Therapeutic Indications:

Desiccated whole blood is used in anemia and chlorosis.

Dose:

Fifteen grains several times per day.

WHOLE BLOOD

(Peptonized)

(See under Peptones)

BLOOD FIBRIN

Source:

From the blood of horses, cattle and hogs.

Description:

Blood Fibrin is a whitish to yellowish brown, horny mass.

Properties:

It is soluble in dilute acids with heat, forming a gelatinous solution.

Uses:

Desiccated pig's fibrin is used in the French Codex as the basic proteid for the estimation of the strength of pepsin.

The uses are, for the most part, technical.

BLOOD ALBUMIN—PURE

Source:

Blood Albumin is the unaltered albuminous principle of blood serum.

Description:

It is marketed in the form of brownish yellow scales and granules, and a dark cream colored powder.

Properties:

Blood albumin is soluble in water for the most part.

Therapeutic Indications:

Medicinally blood albumin is used to replace the usual ferruginous tonics. Technically it is used in dyeing and in the leather trade.

Dose:

The dosage is from seventy-five to one hundred fifty grains in wine or syrup. It is also administered in capsules.

IRON ALBUMINIZED

(See under Iron Salts)

IRON PREPARATIONS

The Iron Salts comprise six important pharmaceuticals:

Iron Albumenized, alcohol soluble,

Iron Dialyzed, solution and scales,

Iron Paranucleinate,

Iron Peptonized 5% and 25% Fe_2O_3, alcohol soluble.

Iron and Manganese Peptonized, alcohol soluble, and

Iron Proteinate.

The organic iron preparation which has established itself in medicine is Iron Peptonized.

IRON PEPTONIZED

Nomenclature:

Peptonized Iron, Peptonate of Iron, and Iron Peptonate are terms often used interchangeably. The first is preferable, because official sanction has been denied the two latter, on the ground that the term "Peptonate" implies a true chemical compound, which in this case cannot be demonstrated. There is a difference of opinion, however, and the trade demands the product, regardless of nomenclature or official disapproval.

As a matter of fact, a properly made Peptonized Iron is a true chemical combination to the extent that it does not give the characteristic reactions of inorganic iron salts or of peptone. The Dispensatories and National Formulary recognize a Latin title, "Ferri Peptonas," the German is "Eisenpeptonat," the French is "Peptonate de Fer."

Source:

Peptonized Iron is made by proper treatment of Iron solutions with Peptone. The Dispensatories recommend a method that well illustrates the general process, which is probably varied by the individual manufacturers according to circumstances.

Description:

Peptonized Iron of commerce occurs as powder, scales, or granules, of varying brown color, of slight peptone odor and taste, non-astrigent, soluble in water, and in alcohol up to about 20%, insoluble in chloroform or ether, and slightly hygroscopic.

The drug trade is accustomed to two standard strengths, one containing 5% Iron, cal culated as Fe_2O_3, and one 25% Iron, calculated as Fe_2O_3. These percentages usually represent the guaranteed amount, but the percentage may exceed these limits by one or two per cent.

Nitrogen is present in amounts from 11% to 12%.

Therapeutic Indications:

Peptonized Iron is used medicinally as a chalybeate tonic, and is considered superior on account of its non-astringent and non-irritating qualities. It is prescribed by physicians and used in proprietary formulae for the treatment of anemias, anorexia, malnutrition, cachexia, debility, delayed convalescence, neurosis, etc.

Preparations Available:

It is marketed in dry preparations, as tablets, pills, capsules, etc., also in liquid form, in conjunction with other medicaments and suitable preservatives.

Dose:

The dose is from five to ten grains.

IRON ALBUMINIZED, ALCOHOL SOLUBLE

Iron Albumenized is a product of exceptional purity. It contains from 5% to 25% iron as Fe_2O_3, is very soluble in water and alcohol (up to 25%), filters clear and remains brilliant and stable after filtration. It is neutral in reaction and is neither astringent nor is it injurious to the teeth.

Source:

This iron salt is made by proper treatment of Iron solutions with blood serum or albumin.

Description:

It is marketed in the form of a brown, very stable powder and garnet red scales.

Properties:

It is odorless and the taste is suggestive of both albumin and iron in a palatable form.

Therapeutic Indications:

Iron Albumenized is used in anemia and chlorosis as a tonic and hematinic and is a very asssimilable iron preparation.

Dose:

It is usually administered in doses of five to twenty grains (.02 to 1.3 grams) in wine, syrup or capsule form.

IRON DIALYZED

Iron Dialyzed is the Basic Ferric Oxychloride.

Description:

It is marketed in the form of a dark reddish liquid, or dark brown scales.

Properties:

It is odorless, the scales are completely soluble in water and the solution is miscible with water in all proportions.

The liquid dialyzed iron contains 5% Fe_2O_3—3.5% Fe.

The scales average from sixty to seventy per cent Fe_2O_3.

Therapeutic Indications:

Dialyzed iron is used in medicine as an arsenic antidote; also in chlorosis, anemia, hemorrhage, cholera, diarrhoea, wounds, etc.

Dose:

The liquid is administered ten to thirty minims at a dose. The scales one-half to ten grains.

IRON PARANUCLEINATE

(Triferrin)

Description:

Iron Paranucleinate is a tasteless, reddish powder made by proper combination of iron solutions with nucleins.

Properties:

It contains nitrogen, phosphorous and iron. It is insoluble in water but soluble in dilute solutions of sodium carbonate.

Therapeutic Indications:

Iron Paranucleinate has hematinic properties. It is used in chlorosis, anemia, and debility.

Dose:

The dose is five grains three times a day.

IRON AND MANGANESE PEPTONIZED

This salt combines the properties of the Iron Peptonized and the Manganese Peptonized salts. The solution of Iron and Manganese is official in the Fourth Edition of the National Formulary.

Source:

This double salt is made by the proper combination of Iron and Manganese solutions with Peptone.

Description:

It is soluble in water and alcohol. The color of the powder varies from buff to dark brown, the scales are bright garnet color. The percentage of Iron and Manganese varies according to the demands of the trade.

Therapeutic Indications:

The double salt is used as a tonic and nutritive.

Dose:

The dose varies according to the percentage of Iron and Manganese incorporated in the mixture.

MANGANESE PEPTONIZED

Nomenclature:

Manganese Peptonized, Peptonate of Manganese, or Peptonized Manganese are terms used interchangeably for the manganese salt.

Source:

Peptonized Manganese is made by proper treatment of manganese solutions with Peptone.

Description:

Manganese Peptonized of commerce is a

buff to brown colored powder of slight peptone odor and taste; soluble in water. Its percentage of Manganic oxide is variable depending upon the amount of metalic manganese desired by the trade, but as a rule it runs from two to five per cent Mn_2O_3.

Therapeutic Indications:

Manganese peptonized is used as a tonic, and nutritive in anemia and chlorosis.

Dose:

The dose is ten to thirty grains.

LECITHIN

Nomenclature:

Lecithin is not official in any of the Pharmacopoeias.

Source:

Lecithin is widely distributed in both animal and vegetable tissues. Commercially it is derived from two sources—egg yolk and animal brains. The product derived from egg yolk has also been called "Ovo-Lecithin."

Description:

Lecithin is a yellowish, waxy mass of peculiar odor and rather disagreeable taste. It is soluble in alcohol, ether, chloroform, benzine and fats; in water it is insoluble, but swells up and in time decomposes. It is somewhat hygroscopic. The standard for purity of egg yolk lecithin requires a product from 90% to 95% pure lecithin.

Properties:

Lecithin contains phosphorous and nitrogen in considerable quantities, the ratio being about 2.2 to 1. The exact chemical composition of lecithin has been determined. It has been shown to contain a certain definite percentage of phosphorous, and the estimation of lecithin purity is based on the determination of the phosphorous content.

Therapeutic Indications:

Lecithin has for years been recognized as a very important substance in human metabolism. It is apparently vital to nearly all animal cells, and particularly so to the nerve cells. It appears to act as a stimulant to nutrition rather than as a direct nutrient itself and has been shown to possess a definite action in increasing the number of red blood corpuscles, the amount of hemoglobin, and improving the appetite, restoring strength, flesh and energy. It is non-poisonous.

Incompatibilities:

Lecithin is incompatible with alkalies, is easily oxidized and should be kept in well stoppered bottles protected from the light.

Dose:

Lecithin is usually administered in doses of from one and one-half grains to eight grains per day in the form of pills, capsules, or in solution with oil, glycerin or alcohol.

NUCLEINIC ACID

Nomenclature:

Nucleinic Acid is not official in any of the Pharmacopoeias.

Source:

The chief source of Nucleinic Acid is yeast. It can also be made from the wheat embryo, sperm of certain fishes, and from the thymus and pancreatic glands.

Description:

Nucleinic Acid is an organic acid obtained from nuclein by the action of alkalies. It is an amorphous, grayish or brownish white powder, and has an acid reaction. It is partly soluble in water, soluble in alkaline waters with the formation of water soluble salts. From these solutions it is precipitated by a slight excess of hydrochloric acid but not by acetic acid. It is insoluble in alcohol and ether. The nucleinic acid of commerce is apt to contain some protein in combination. Theoretically it contains between 14.5 to 16.5% of nitrogen and between 8.5 and 10.5% of phosphorous, but the nucleinic acid of commerce does not contain quite so much phosphorous, averaging between 6 and 8%.

Therapeutic Indications:

Nuclein, Nucleinic acid and Nucleates are said to increase the number of white corpuscles, and it has been claimed that they increase the resistance to infections.

Nucleins are the chief chemical constituent of cell nuclei, and their number is limited only by the variety of cells. They are found in both animal and vegetable tissues; wherever there is a nucleus we find nuclein. They are generally insoluble in dilute acids, but are soluble in dilute alkalies, and resist peptic digestion. Their function in the organism is supposed to be two-fold:

(1) That of a natural antiseptic, to destroy toxic products which may accumulate through faulty elimination, and

(2) That of a natural bactericide, to resist microbic invasion.

Two nucleins have been clinically studied in this country, that obtained from yeast cells and that from animal glands, especially thymus and thyroid.

Nuclein is harmless, causing no functional derangement when administered by the stomach or by subcutaneous injection, even in large doses.

Its employment as a therapeutic agent is based upon the asumption that for immunity against and the cure of bacillary diseases we should look to non-toxic germicides of cellular origin, and to substances which stimulate the activity of those organs whose function it is to protect the body against such invasion. As the nucleins apparently fulfill these requirements they have excited considerable attention among advocates of animal extracts. Nuclein has been successfully used in diphtheria, suppurative tonsilitis, and other suppurative disorders; also chronic rheumatism and malaria, chronic bronchial catarrh and neurasthenia and has been employed in tuberculosis with encouraging results. In one case an ulcer of twenty years standing was cured in four months by local application of nuclein.

In simple anemia, chlorosis, typhoid fever, debility from any cause, and from convalescence from acute diseases, such as pneumonia and influenza, the benificial results of nuclein medication are prompt and permanent.

As bactericides the nucleins may prove useful by reason of their harmlessness to the human subject.

Dose:

Tablets of nuclein are on the market, for oral administration, the dose being one to five grains or more as may be deemed advisable. It is probable that in oral administration the nucleinic acid enters the circulation and circulates unchanged. It has been asserted to have an extraordinary power in improving the general nutrition.

SODIUM NUCLEINATE

Nomenclature:

Sodium Nucleinate is not official.

Source:

From Nucleinic Acid, it being the sodium salt of the acid.

Properties:

Sodium Nucleinate is soluble in water for the greater part.

Dose:

The indications and dose are the same as described under Nucleinic Acid. Thirty minims of a 1% solution, administered hypodermically, and increased daily as long as no in-unfavorable symptoms appear, are recommended. It can also be given in a 5% solution.

PEPTONE

Nomenclature:

In chemistry the term "Peptone" (Lat. Peptonum) is applied to a certain class of intermediate substances resulting from the hydrolysis or digestion of proteins. Peptones possess complex molecular formulae, which can hardly be expressed graphically; although they are simpler than their parent proteins or proteoses, yet they are more complex than their amino-acid derivatives. Peptones have certain characteristic properties by which they are distinguished from other products of hydrolysis, but it is probable that they rarely are found in a pure state.

In commerce the term "Peptone" has been very loosely used, first, because Witte's Peptone is a staple in the trade, and is almost entirely a proteose mixture, rather than a peptone; and second, because no official definition or standard has heretofore existed. In France the Codex includes "Medicinal Peptones," although the specifications and tests are lenient and incomplete. In the U. S. P. IX, Part II, under "Reagents and Test Solutions," there is a definition of "Peptone (Beef Peptone)," but the tests are such that commercial articles will rarely be found to meet them.

Source:

Peptone is obtained from many different kinds of natural proteins, such as meats, cereals, eggs, milk, blood, etc. They are produced by hydrolysis with acids, alkalies, heat, or enzymes, or a combination of these agencies. It is difficult to determine from an analysis of peptone the nature of the parent proteid.

Description:

Peptone of commerce occurs in the form of a dry powder, or a stiff paste. It is buff to brownish in color, meaty odor, meaty and bitter taste. True peptone is completely soluble in water, giving a yellowish clear solution; in alcohol it is soluble up to 30% and sometimes more. Insoluble in chloroform and ether. Aqueous solutions quickly putrefy if not sterilized or protected by antiseptics.

Properties:

Peptones are rich in nitrogen, good grades showing about 14% and more. The nitrogen is the chief criterion in estimating the quality of a peptone; with it are the important qualities of odor, solubility, and purity. They are usually slightly acid in reaction, the ash content is variable depending upon the source of the parent proteid and method of hydrolysis. They are rather hygroscopic.

Therapeutic Indications:

Peptones are used in drug and food preparations for their nutritive value, which depends entirely upon the nitrogen content.
Peptone is an important nutrient for invalids, as it does not tax the digestive organs and is immediately and completely assimil-

able, given either by mouth or by enemata. Beef Peptone Paste due to its high content of nitrogen, is being substituted more and more for Beef Extract in the N. F. formula for Beef, Iron and Wine. Bulletin No. 127 of the United States Department of Agriculture states that 50 c.c. of Beef, Iron and Wine should yield not less than 0.115 grams nitrogen coming from the beef extract.

There is no standard nitrogen content for beef extract and so manufacturing pharmacists are turning to the accurately standardized Beef Peptone, in either paste or powder form, as a substitute for the beef extract and as a source for their nitrogen.

During the past few years beef peptone has been employed by some physicians in Europe:

(1) as an anti-anaphylactic agent, and

(2) as a non-specific protein.

Non-specific protein therapy is not a new therapeutic discovery, in fact milk was used intravenously quite extensively in the seventeenth century in England in the treatment of a variety of pathological conditions.

In cases of psoriasis beef peptone orally has very little value, but by hypodermic injection (thirty-three per cent beef peptone twice a week) it has proven quite satisfactory.

In eczema a teaspoonful of a ten per cent solution one hour before meals has often caused the disappearance of an eruption previously rebellious to the usual method of treatment. From one to three minims of a thirty-three per cent Beef Peptone solution injected into patients suffering from bronchial asthma will result sometimes in spectacular results but it should be noted that Beef Peptone injections are not indicated in all cases of asthma, but are advisable only when the common methods of controlling this disease have failed.

Bacteriological Peptones are subdivided into two different heads:

Bacto Peptone, and
Proteose Peptone.

Bacto Peptone consists essentially of peptones and amino acids and is recommended for special and routine work, as in culture media for the examination of water, milk, sewage, etc.

Proteose Peptone, as its name implies, is high in proteoses and is recommended for toxin production where a toxin of high M. L. D. is desired.

Preparations Available:

There are two representative types of peptone purchasable—the Pharmaceutical and the Bacteriological.

The pharmaceutical peptones are made and designated according to the protein from which they are manufactured, namely: Beef, Egg Albumin and Whole Blood. These pharmaceutical peptones are marketed in the form of the desiccated powder.

The two bacteriological peptones are also marketed in the form of the desiccated powder.

GLYCEROLE OF RED BONE MARROW

Nomenclature:

Red Bone Marrow is not official.

Source:

Glycerole of Red Bone Marrow is a palatable combination of the soluble constituents of the bone marrow in chemically pure glycerin. It contains the soluble essential therapeutic constituents of marrow cells, hemoglobin, and other blood-forming substances.

Therapeutic Indications:

Glycerole of Red Bone Marrow is indicated in cases where an increase of hemoglobin and red corpuscles is desired. It is recommended for use after hemorrhage, in treatment of tuberculosis, chlorosis, marasmus, leukemia, Addison's disease, Bright's disease, bone necrosis, and in gynecological and obstetrical cases.

Red Bone Marrow is considered one of our best remedies in the various anemias; it is also of great value in increasing the leucocytes.

Dose:

The adult dose is one-half teaspoonful three times a day. In cases of sensitive stomach it is well to dilute the glycerole with water or milk. The sweet taste can be masked by the addition of lime or lemon juice, or some bitter principle like strychnine, calisaya, or gentian.

SILVER PREPARATIONS—COLLOIDAL

Nomenclature:

Colloidal Silver preparations are not recognized in the various Pharmacopoeias, but are mentioned in New and Non-Official Remedies. There are two well known types of preparations:

Silver Proteinate carrying between eight and ten per cent metallic silver, and

Silver Nucleinate carrying approximately twenty to twenty-five per cent metallic silver.

Source:

Colloidal Silver preparations are made by the proper treatment of silver solutions with proteins.

Description:

In these colloidal silver salts the silver does not exist (at least not to any great extent) as free ions. Therefore a solution of the salts does not exhibit the general chemical characteristics of inorganic silver salts in solution. It does not precipitate with chlorides or proteins.

Properties:

Silver Proteinate is marketed as dark brown spongy granules or powder, containing eight to ten per cent metallic silver, non astringent and non-irritant. It is completely and quickly soluble in water as well as pure glycerin and a mixture of 50-50 glycerin and water. Free silver and chlorine ions are not present. It probably consists of indefinite mixtures of metallic silver, silver oxide, and the proper protein, all in colloidal form.

Silver Nucleinate resembles the proteinate in general character. It contains more silver, the content being between twenty and twenty-five per cent metallic silver.

Therapeutic Indications:

The colloidal silver compounds are used mainly on mucous membranes, for antiseptic and germicidal effects.

Dose:

The concentrations of the salt for mucous membranes range from 0.1% to 10% for the silver proteinate, and 5% to 20% for the Silver Nucleinate. These are applied every two to four hours, if possible. Solutions should be freshly prepared and protected against the light.

SODIUM CASEINATE

Nomenclature:

Sodii Caseinas; Casein-natrium; German, Nutrose.

Source:

Sodium Caseinate is made by combining the proper amount of alkali with freshly precipitated casein.

Description:

A white to grayish amorphous powder, with a slight casein odor and taste, insoluble in alcohol and ether, slightly so in cold but readily soluble in hot water.

Therapeutic Indications:

Used as a nutrient like peptone. It is regarded as a valuable food in digestive and intestinal disorders. Valuable in anemia and scrofula.

Dose:

Teaspoonful several times per day in milk, chocolate, or bouillon.

INDEX

Adrenal Gland 41
Amylopsin 57
Anterior Pituitary Lobe 34
Appendix 11
Beef Extract (Pharmaceutical) 69
Bile Preparations 69
Bile Salts Compound 73
Blood Albumin 76
Blood Fibrin 76
Blood Preparations 74
Brain Substance 11
Cardiac Substance 13
Cerebral Substance 11
Corpus Luteum 25
Corpus Luteum Solution 26
Diastase (from Malt) 61
Diastase (from Pancreas) 57
Duodenal Substance 14
Digestive Enzymes 51
Endocrines 7
Epinephrin 43
Epinephrin Chloride Solution 1:1000 43
Fel Bovis Purificatum 71
Glycerole of Red Bone Marrow 89
Heart Substance 13
Hemoglobin 74
Hypophysis Liquor 33
I'lang-hans 29
Invertase 62
Iron Albumenized (Alcohol Soluble) 79
Iron Dialyzed 80
Iron Paranucleinate 80
Iron and Manganese Peptonized 81
Iron Peptonized 77

INDEX (Continued)

Iron Preparations 77
Islets of Langerhans 27
Kidney Substance 15
Lecithin 82
Leydig Cells 16
Liquor Hypophysis (Obstetrical) 33
Liquor Hypophysis (Surgical) 33
Liver Substance 17
Lung Substance 19
Lymphatic Glands 20
Mammary Glands 21
Manganese Peptonized 81
Nucleinic Acid 83
Orchic Substance 22
Orchic Solution 23
Ovarian Residue 26
Ovarian Solution 24
Ovaries 23
Oxgall (Desiccated) 71
Oxgall (Desiccated, Purified) 71
Oxgall (Inspissated) 71
Oxgall (Pilular) 71
Oxgall (Powdered) 71
Oxgall (Powdered Extract U.S.P. IX.) 72
Oxgall (Purified) 71
Pancreatic Enzymes 55
Pancreas Islets 27
Parathyroid Gland 30
Parotid Gland 38
Pepsin 52
Peptone 86
Pineal Gland 31
Pituitary Body 32
Placental Substance 36

INDEX (Continued)

Posterior Pituitary Lobe 33
Prostate Gland 37
Protein Compounds 67
Ptyalin 64
Renal Glomerular 15
Rennin 59
Salivary Glands 38
Secretin 64
Seminal Vesicles 39
Silver Nucleinate 91
Silver Preparations (Colloidal) 90
Silver Proteinate 91
Sodium Caseinate 92
Sodium Glycocholate 72
Sodium Nucleinate 85
Sodium Taurocholate 72
Spinal Cord 39
Spleen Substance 40
Steapsin 58
Sublingual Gland 39
Submaxillary Gland 39
Suprarenal Gland 41
Thymus Gland 43
Thyroid Gland 45
Tonsils 47
Triferrin 80
Trypsin 57
Whole Blood (Desiccated) 75
Whole Blood (Peptonized) 76
Whole Pituitary Gland 35

MIT LIBRARIES TRIP
3 9080 02762 8723